

USING SCIENCE TO DICTATE DEWORMING DOLLARS FOR DAIRY OPERATIONS

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Dairy producers are very concerned about the cost of production. Losses, especially those caused by preventable disease such as gastro-intestinal parasitism, become extremely important especially in times of increased production costs coupled by high feed cost and low milk prices. The cost of parasitism begins with a depressed immune system; followed by reduced growth in calves and yearling cattle, reduced reproductive efficiency in breeding animals as well as the direct effect of reduced feed intake, reduced feed efficiency and reduced milk production (Fox et al., 1989; Hansen, 1985; Kelly, 1973; Smith et al., 2000; Stromberg, 1997; Todd et al., 1978). Further economic justification for routine deworming of dairy cattle has come from recent research data that indicate that the suppression of the immune system can impact a number of key husbandry issues such as reducing the efficacy of vaccines and allowing a number of disease conditions such as coccidiosis or pink eye to flourish through reduced immune function (Kamal and Khalifa, 2006). Knowing how to reduce or prevent these losses can be very valuable to the efficiency of an operation since losses caused by parasitism is cumulative in the animals affecting all age groups of cattle from young calves to adult cows. Profitability attained from improved efficiency due to parasite removal can be determined by subtracting the cost of the annual deworming program in an operation from the potential losses incurred by parasitism if left unchecked.

Foremost in the economic analysis is the ability to detect the presence or absence of parasitism within a herd. To date, the best method to determine whether parasitisms are present within a herd is by conducting a fecal check counting the number of parasite eggs present in a specific sample size and identifying the type of parasite present based on the characteristic size and shape of the eggs found. Adult female nematode parasites living within the gastrointestinal tract lay eggs that pass out in the manure. The eggs hatch producing larvae which molt several times until they reach an infective stage. These infective larvae are mobile, moving away from the manure pat to nearby vegetation where they can be eaten by grazing cattle starting the life cycle over again. When parasite eggs are being passed down the gastro-intestinal tract and excreted in the manure, they can be found by floating the eggs out of the manure using a special flotation medium. There are many different types of fecal exams, but the only flotation test that is sensitive enough to use with adult dairy cattle is called the "Modified Wisconsin Sugar Flotation Method" (Bliss and Kvasnicka, 1997; Dryden et al., 2005). It is the only fecal exam that has a sufficiently high degree of sensitivity to consistently find parasite eggs in adult dairy cattle harboring parasites where these cows can excrete in excess of 90 pounds of manure daily.

RISK FACTORS AND PRODUCTION LOSSES

With internal parasites, it is well established that even a few parasites present during early lactation become a detriment to achieving production potential (Bliss and Todd, 1976). Parasitized cattle are harmed, not only by the parasites themselves, but also by the indirect damage the parasites cause to the immune system. Grazing cattle have the greatest risk since their exposure to parasites is higher than cattle housed on dirt lots or in a confined facility. Deworming studies conducted in the U.S. have demonstrated lactating dairy cows exposed to gastrointestinal parasites may lose from 423 to 1,280 lb milk per lactation due to internal parasites (Table 1). The greatest responses came from high-producing herds with some exposure to internal parasites dewormed at freshening and again six to eight weeks later. These studies showed that by removing parasites during the period of greatest stress in early lactation, production losses due to internal parasites could be prevented.

Table 1: Published trials measuring parasite effect on milk production in lactating dairy cows following deworming treatment or artificial parasite exposure. From ¹(Bliss and Todd, 1973) ²(Bliss and Todd, 1977) ³(Bliss and Todd, 1974) ⁴(Bliss and Todd, 1976) ⁵(Todd et al., 1978).

Study Location	No. of Herds	No. of Cows	Production Deworming Strategy	Benefit
Wisconsin ¹	22	1,003	Whole herd deworming	+ 366 lbs/cow
Wisconsin ²	1	48	Cows <90 days challenged	+ 1,280 lbs/cow
Wisconsin ³	12	488	Dewormed at freshening	+ 423 lbs/cow
Vermont ⁴	9	267	Parasite-free first 90 days	+ 534 lbs/cow
Pennsylvania ⁵	9	180	Parasite-free first 90 days	+ 769 lbs/cow
North Carolina ⁵	5	160	Parasite-free first 90 days	+ 1,075 lbs/cow
Overall	58	2,146	Parasite-free in early lactation	+ 507.0 lbs/cow

CONDUCTING FECAL EXAMS

The biggest issue in solving parasite problems and developing treatment programs for dairy operations is that each farm or animal raising facility has its own individual parasite profile. How and where cattle are raised on a particular operation will impact whether or not they are exposed to internal parasites. It will also determine what type of parasites they become exposed to throughout their lives beginning as a new born calf continuing to an adult animal. Since these internal parasites cannot be seen, their presence can only be determined through science. The only non-intrusive diagnostic test for detecting parasites that has survived the test of time which can accurately determine the presence or absence of parasitism in both dairy and beef cattle is the fecal exam.

Having a test that can reliably determine the absence of parasitism is equally important. If, for example, a dairy herd held in total confinement show negative fecals, deworming these animals are probably a waste of time and money for the producer. These deworming dollars are better spent deworming those animals or groups showing positive fecals. The issue becomes, therefore, for a dairy operation to know whether not parasites are present for each age or management category of animals on an operation and applying their deworming dollars to those animals that show parasite infections.

Accurate fecal examinations allow the veterinary or nutritional advisor to provide a scientific approach to help producers make decisions about their deworming strategies. The fecal examination gives definite information on the level of worm egg shedding as well as on the general types of parasites present in each category of animal examined. The level of worm egg shedding indicates the parasite prevalence and determines the potential for future infection of new animals moving into a particular pen or pasture. When combining the knowledge of the epidemiology of gastrointestinal parasitism under local conditions and the knowledge of the client's management practices, the fecal exam results provide the veterinarian or nutritionist the necessary tools to design the least-cost most-efficacious parasite control strategy.

The problem with the fecal exam, however, is that most veterinary schools, diagnostic laboratories, veterinary hospitals and veterinary clinics use one of the many inefficient commercial fecal exams that exist and are promoted for use in cattle; however, all these tests lack the necessary sensitivity to provide accurate results especially in samples taken from adult lactating dairy cows or adult beef cows raised in extensive grazing systems. Two problems exist with the use of an inaccurate fecal exam. The first problem is when producers request a fecal exam be conducted on their cattle which, in turn, produces a negative result the producers falsely assume the tested cattle are parasite-free. The second problem is that no further exams are requested since the producer assumes that the tested cattle are parasite-free and, therefore, assumes that no further testing is necessary. So not only does the incorrect fecal exam produce false negative results costing the producer lost production but also then the producer decides that no further testing is required preventing this producer from finding the true answer allowing the production loss to parasitism to continue.

THE MODIFIED WISCONSIN SUGAR FLOTATION TECHNIQUE

The lactating dairy cow presents a unique problem because of the large amount of fecal material excreted every day. This large volume dilutes the egg count. Because of the large volume of manure excreted each day, looking for gastro-intestinal worm eggs in the manure is like looking for "a needle in a hay stack." The Modified Wisconsin Sugar Flotation Technique, therefore, is the only fecal exam technique that has the necessary sensitivity the dairy practitioner or dairy industry can trust. The other advantage of the Modified Wisconsin Sugar Flotation Technique is that the flotation medium heated to form the solution (a super-saturated sugar solution (specific gravity 1.27) then cooled before use is neither hypotonic nor hypertonic, and therefore, the worm eggs recovered are not distorted by the sugar and can accurately be identified by

egg shape and size and/or stage of embryonic development. (Bliss and Kvasnicka, 1996) The Modified Wisconsin Sugar Flotation Technique has been shown to be the most sensitive fecal exam technique to use for all animal species including dogs and cats (Dryden et al., 2005).

DEVELOPING AN ABILITY TO MONITOR DAIRY CLIENTS

There are a number of ways for dairy nutritionists and veterinary practitioners around the country to monitor their client's herds as follows:

1. If not already available, set-up lab support capabilities within veterinary clinics - Merck Animal Health will help train technicians on the Modified Wisconsin Sugar Flotation Technique.
2. Order a complete fecal assay kit ready to use with all supplies necessary for conducting the Modified Wisconsin Sugar Flotation Method from JorVet - Jorgensen Laboratories, Inc. 1450 Van Buren Avenue, Loveland, CO 80538 (800-525-2614) or INFO@JorVet.com
3. Send samples to the following address supported by Merck Animal Health as listed below:
MidAmerica Ag Research, 3705 Sequoia Trail, Verona, WI 53593

Once lab support is completed for a producer, the first step is to determine the parasite profile for different age groups of cattle for each dairy operation in the practice. Parasite types and parasite control strategies can best be determined by age and management group. There is a scientific trend toward which type of parasites one can expect to find depending upon animal age and management style for raising calves, replacement heifers, bred heifers and cows. "barnyard parasites" are the common parasites found in calves and yearling cattle that have not been exposed to pasture. These parasites contaminate calf raising areas of an operation such as barnyard, pens and limited grazing situation such as fenced in areas around barnyard and often provide a constant source of infection.

MONITORING FOR PARASITE RESISTANCE:

The history of the detection of anthelmintic resistance in cattle began as early as 1997 when a Fecal Egg Count Reduction Test (FECRT) was conducted in New Zealand showed that the macrocyclic lactone pour-ons doramectin (Dectomax® – Pfizer, Inc.) and ivermectin (Ivomec® – Merial) failed to control parasites as well as a macrocyclic lactone injectable formulation of doramectin (Gaynard et al., 1999). The first field study where parasite resistance was confirmed with actual worm counts taken at necropsy was conducted in Wisconsin (Gasbarre et al., 2004). In this study, the efficacy of doramectin, moxidectin (Cydectin® – Boehringer Ingelheim Vetmedica Inc), eprinomectin (Eprinex® – Merial) and Ivomec® Plus (Merial) was tested. Comparing worm counts with non-medicated control cattle, the efficacy of moxidectin was 88.0%,

doramectin was 64.1%, fenbendazole (Safe-Guard/Panacur-Merck Animal Health) was 96.5%, eprinomectin was 73.1% and Ivomec® Plus was 0%. All four macrocyclic lactone compounds tested were identified with parasite resistance, with efficacies below the desired efficacy of 90% or greater (Woods et al., 1995).

Parasite resistance with eprinomectin and moxidectin were further investigated using the Fecal Egg Count Reduction Test protocol in two separate studies at the University of Illinois Dixon Spring Agricultural Station in Simpson, Illinois (Hart and Bliss, 2006). Cattle receiving eprinomectin or moxidectin for the second time during a summer grazing season demonstrated reduced efficacy indicating the development of parasite resistance. The efficacy of eprinomectin in the first trial was 84.8% and dropped to 5.5% in the second trial while moxidectin averaged 74.7% in the first trial and 0% efficacy in the second trial. The fecal worm egg count results from this study revealed that the parasites which survived the first pour-on treatment were completely refractory to the second treated for both eprinomectin and moxidectin.

Monitoring parasite resistance on dairy operations where macrocyclic lactone pour-on dewormers have been used for a number of years should be instituted. Veterinary clinics, dairy practitioners and nutritionists can easily use the FECRT protocol to quickly check to see if products used by producers are still efficacious on the operation by conducting a fecal exam at the time cattle are treated and again 14-days after treatment according to the attached protocol.

DEWORMING CONTROL STRATEGIES

Knowing whether parasites are present on the operation or knowing where on the operation active parasite contamination is taking place is the first step to establishing a control strategy. Since each herd is different, determining how much exposure the animals have or have had to a parasite-contaminated environment and then focusing on this part of the operation is the best way to start the parasite reconnaissance process. By first identifying areas of the operation where the greatest chance for parasite contamination to develop and then confirming the presence of parasite through conducting fecal worm egg counts, a control strategy can be developed. Several key points are that animals which have spent time in confinement for longer than six months have the least chance of being parasitized. Parasite contamination on concrete is usually very low except where bedding and manure build-up occur. Parasite transmission in dairy herds predominantly occurs on pasture, exercise lots, and dirt lots, therefore, identifying these areas or operations where parasites are most likely to exist on an operation and then concentrating on these areas for conducting initial worm egg counts and setting up treatment programs will save a lot of time and money.

Once parasite presence is established, a control strategy can be implemented. Four steps are necessary for successful prevention of parasitism:

- 1) Select correct product: A deworming product should be highly efficacious with 95% efficacy against all important internal parasites (including lungworms) and all stages of the parasite within the animal. Many of the barnyard infections such as whipworms, tapeworms, *Nematodirus* are not controlled by the macrocyclic lactone products (injectable nor pour-ons) and, therefore, the benzimidazoles are the dewormers of choice for these categories of cattle. This strategy is important because late fall deworming should remove all parasites in the animal at the time of the treatment so that the cattle remain parasite-free until the following spring. For deworming lactating dairy cows without milk withdrawal, fenbendazole is available as an oral drench, paste, top-dress or medicated feed mix while eprinomectin and moxidectin pour-ons are both available with no milk withholding period. Since the macrocyclic lactone pour-ons and injectables have both shown parasite resistance in recent years; a fecal check is necessary to make sure the dewormer chosen is working.
- 2) Select correct treatment time: The best dewormer used at the wrong time is a wasted resource. Pastured cattle should be parasite free during the winter months and treated strategically in the spring once grass green-up or turn-out occurs. Young and yearling cattle usually need two strategic dewormings on spring pasture (Dairy Tech Bulletin, 1992; Herd et al., 1980). Eprinomectin has been shown to kill dung beetles and therefore should not be used in grazing cattle (Wardhaugh et al., 2001).

Deworming replacement heifers to prevent parasite infections provides the dairy producer one of the best tools for raising healthy heifers on pasture. Pasture treatment involves strategic timed dewormings for young stock by making sure all animals are parasite-free at the time of spring turnout followed by two successive treatments given 30-days apart (0-30-60 day program) to ensure cattle are free from shedding parasite eggs back on the pasture for the first 90-days of the grazing period. This treatment has shown to reduce parasite contamination on the pastures for the entire grazing season. Replacement heifer deworming trials conducted in Minnesota, Wisconsin, Virginia and Vermont demonstrated strategically dewormed heifers reached breeding size 28 to 68 days sooner than non-dewormed heifers (Table 2).

Table 2: Weight gain and time to breeding size benefit in replacement dairy heifers strategically dewormed with fenbendazole (Safe-Guard®/Panacur®-Merck Animal Health). From ¹(Myers and Todd, 1980), ²(Kunkel and Murphy 1988), ³(Hansen, 1985), and ⁴(Dairy Bulletin, 1992).

Study Location	No. of Herds	No. of Heifers	Weight Gain Benefit Reduced Time to Breeding Size
Wisconsin ¹	1	45	+44 lbs./35 days earlier
Vermont ²	4	60	+38 lbs./28 days earlier
Virginia ³	1	18	+60 lbs./58 days earlier
Minnesota ⁴	25	539	+107 lbs./68 days earlier

- 3) Treatment can be given to lactating cows three different ways: on a herd basis, an individual basis or a combination thereof:
 - A. Whole herd treatment in grazing herds - This strategic treatment regime should be initiated in late fall with a follow-up deworming given four to six weeks into spring grazing or six weeks after spring turnout. Pour-on treatment for lice or mange treatment can be given during winter months when external parasites are observed.
 - B. Individual or group treatment - Deworming individual cows to ensure parasite-free status for the first 100 days in milk requires the first treatment should be given prior to calving or use feed through dewormer in the pre-fresh or transition group. In grazing herds, the second deworming should be given around 6 weeks post-partum in grazing cow. Some practitioners administer the second deworming at the time of pregnancy checks since the cows are usually constrained at this time.
 - C. Combination treatment - All Cows are dewormed in late fall and then a follow-up deworming is given individually throughout the year as each cow freshens. Pour-on treatment for lice or mange treatment can be given during winter months only when external parasites are observed.
- 4) Yearly maintenance treatment program: The economic benefits from strategic deworming improve each year as parasite contamination is reduced in the animals' environment.

CONCLUSIONS AND TREATMENT RECOMMENDATIONS

For animal to remain an economical food supply source and for dairy operations to animals become as efficient as possible, efforts to eliminate losses due to parasitism must continue. Deworming dairy cattle is a venture beyond treating clinical disease such that the treatment of parasitism should be aimed first at the elimination of the threat of economic loss and secondly to reduce or elimination of the parasites and parasite contamination of the facility where the cattle are raised. The dairy practitioner and

nutritionist can play a vital role by using science to determine where, when and which cattle need deworming, providing an efficient way to use deworming dollars and make sure that cattle are not being treated unnecessarily or those cattle which need treatment received the necessary treatment.

The first step in this process is to profile each herd identifying where parasites exist throughout an operation starting from new born calves to mature cows and then determine the deworming strategy for each phase based fecal worm egg counts and the type of parasites found. Most herds need a dewormer somewhere on the operation; however, many totally confined herds which use a dewormer in their milking herd can save this money and more accurately applied these deworming dollars to other management groups within the operation where parasites has been detected as determined by fecal worm egg counts. One important point to remember in determining the exact location of where the parasite contamination within a herd took place is to calculate back three to six weeks from where the worm eggs were found to where the animals actually became infected. An example would be to check early fresh cows to determine whether the cows were becoming infected during the dry period. The time necessary for the development of a patent infection to occur in the animal after infective stage parasite is consumed is usually between three and six weeks depending upon the specific parasite and the age and immune status of the animal being infected.

For conducting a fecal exam, make sure representative individual samples are taken from the various aged groups in each operation and from cows in different stages of lactation including dry cows. A recommended sampling of 5% to 10% of the herd is adequate depending upon the size of the operation. For conducting a FECRT checking for parasite resistance, fecal samples from a total of 15 to 20 animals at the time of treatment and 14-days following treatment is necessary to properly calculate efficacy.

The following are suggested guidelines for developing deworming strategies for a dairy operation to prevent production losses due to gastrointestinal parasitisms:

- 1) If the lactating herd is in total confinement, treatment is probably unnecessary but should be confirmed by a fecal exam.
- 2) If a herd in is total confinement but the dry cows are on pasture, the cows should receive treatment when they are moved off pasture either in transition or just prior to freshening.
- 3) If a herd is held in total confinement, dry cows are in confinement, but replacement heifers are raised on pasture. Deworm these heifers strategically during the pasture phase and then make sure all first calf heifers are dewormed prior to arrival into the lactating herd or prior to freshening.

- 4) If all cattle are held in confinement from birth until reaching the lactating herd; conduct fecal checks throughout different age groups looking for barnyard infections in the different management groups and then deworm all animals coming into the herd either as replacement animals or newly purchased replacement cows to make sure parasites are not introduced to the herd.
- 5) Grazing herds can be treated on an individual basis, herd basis or a combination by deworming all animals in the fall and then deworming individual cows at the time of calving during the year (especially those animals on pasture during the summer grazing season).
- 6) If a herd has used a macrocyclic lactone pour-on (eprinomectin or moxidectin) for several years in a row, post-treatment fecal exams or a Fecal Egg Count Reduction Test should be conducted to check for the development of parasite resistance.

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